Electricity Distribution

nationalgrid

Company Directive

ENGINEERING SPECIFICATION
EE SPEC: 5/6

Relating to 11kV Distribution Transformers

Policy Summary
This specification covers the requirements for Distribution Transformers from 25kVA single phase to 1000kVA three phase for use on Western Power Distribution's system. It is based on ENA Technical Specification 35-1 Issue 6 - June 2014.

Author: **Andrew Reynolds**

Implementation Date: **September 2020**

Approved by

Carl Ketley-Lowe

Engineering Policy Manager

Date: **4th September 2020**

Target Staff Group	**Network services teams, Purchasing, DMs, TMs, Logistics, Engineering trainers, Fitting teams, Overhead teams**
Impact of Change	**Amber**
Planned Assurance checks	**Check that stores hold these transformers before the cut off date, issue of new contracts for these transformers in a timely manner for the cut off date**

All references to Western Power Distribution or WPD must be read as National Grid Electricity Distribution or NGED

IMPLEMENTATION PLAN

Introduction

This document defines the 11/.433 Distribution Transformers used within WPD and provides a standard with which the Purchasing section can go out to tender with.

Main Changes

The document has been updated to include the latest Eco Directive for transformer losses.

Impact of Changes

From 1st July 2021 we will be required to purchase and install transformers meeting the new specification, the decision has been made to introduce a new contract before this cut off date to make sure that all stock is to the new specification this date is anticipated to be 1st April 2021.

Implementation Actions

Procurement will tender a revised transformer contract.

Implementation Timetable

Once the contract has been revised and awarded, teams will see the new specification units being delivered to them. This is expected to be April 2021 onwards.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
September 2020	• Inclusion of tier 2 losses • Update to latest version of ENATS 35-1 • Split document in to parts as per ENATS 35-1	Andrew Reynolds
August 2014	• Change of losses to new Eco losses in accordance with General formatting changes	Andrew Reynolds
July 2013	• Update to include Surge Arrestors • Included references for the Midlands • Inclusion of padmounts	Andrew Reynolds
July 2013	• Inclusion of Revision table	Andrew Reynolds

Contents

1.0 SCOPE

This specification covers the technical requirements for single-phase and three-phase, 50Hz, oil immersed, naturally cooled, transformers in the range 25kVA to 1000kVA for continuous service suitable in all respects for indoor or outdoor service.

Sections 1 to 14 are applicable to all types of Distribution Transformers.
Section 15 covers specific details applicable to Cable Connected Transformers.
Sections 16 and 17 cover specific details applicable to Unit Type Transformers.
Section 18 covers specific details applicable to Pole mount Transformers.
Section 19 covers specific details applicable to Padmount Transformers.

2.0 FOREWORDS

All equipment supplied under this specification will meet the relevant technical requirements of

ENA Technical Specification 35-1, Issue 5, June 2007 - Distribution Transformers (from 16kVA to 2000kVA).

ENATS 35-1 Part 1 Issue 2014 Common clauses
ENATS 35-1 Part 2 Issue 2014 Ground mounted transformers-not close coupled
ENATS 35-1 Part 3 Issue 2014 Ground mounted transformers-close coupled
ENATS 35-1 Part 4 Issue 2014 Pole mounted transformers

Additional clauses contained within this specification are in addition to the requirements of the standards outlined in ENA Technical Specification 35-1. Where there is any conflict between ENA Technical Specification 35-1 and this document, then this specification shall take precedence.

The transformer and its ancillaries shall be designed such that it can continue in operation in times of flood when water levels could reach 1m above the plinth level.

Clause numbers in this specification correspond to clause numbers in ENA Technical Specification 35-1.

Three phase transformers shall be connected Delta-Star, in accordance with vector group reference Dyn11 of IEC 60076.

All three phase transformer losses are now in accordance with European Eco Directive 2009/125/EC. Single phase transformer remain unaffected by the Eco Directive.

PART 1 COMMON CLAUSES

All Clauses of this section are as ENA Technical Specification 35-1 Issue 6 Part 1

3.0 DEFINITIONS

Clause 3 of ENA Technical Specification 35-1 part 1 applies.

4.0 SERVICE CONDITIONS

Clause 4 of ENA Technical Specification 35-1 part 1 applies.

5.0 RATING AND GENERAL REQUIREMENTS

Clause 5 of ENA Technical Specification 35-1 part 1 applies.

5.1.2 **Preferred values of rated power**

The standard rated powers, rated voltages and impedance shall be as per Table 1 ENA Technical Specification 35-1 part 1.

6.0 REQUIREMENTS FOR TRANSFORMERS HAVING A TAPPED WINDING

Clause 6 of ENA Technical Specification 35-1 part 1 applies.

Clause 6.4 the tapping specifications shall meet the relevant parts of ENA TS 35-1 parts 2, 3 and 4

Clause 6.6 - Capitalisation figures shall be used for tender comparison purposes. However, in any event, the transformer losses shall meet, or be lower than, those specified below and shall be in accordance with 2009/125/EC. Also conforming to Regulation No 548/201.

The energy performance of all transformers supplied as part of this engineering specification shall be at its ONAN rating and shall comply with the max allowed values of load losses and no load losses for Tier 1 until 30th June 2021 and Tier 2 losses 1st July 2021 it is WPD intention to have Tier 2 compliant transformers in place by 1st April 2021 to allow a smooth transition on the 1st July 2021.

Losses stated below are Tier 2 losses, all three phase pole mount transformers supplied to Western Power shall conform to table I.1 of the Eco directive 2009/125/EC and No 548/2014. It is Western Powers intention to only stock transformers that meet or are lower than the loss levels of this table.

Single Phase pole mounted transformer losses

Single phase rating - kVA	**25**	**50**	**100**
No Load Loss	65	113	243
Load Loss	559	973	1636

Three phase pole mounted transformer losses

Three phase rating -kVA	**25**	**50**	**100**	**200**	**315**
No Load Loss	63	81	130	225	324
Load Loss	600	750	1250	2015	2800

Three phase ground mounted transformer losses

Three phase rating -kVA	**500**	**800**	**1000**
No Load Loss	459	585	693
Load Loss	3900	6000	7600

Pad mount transformer losses

Pad mount transformers -kVA	**50 single phase**	**100 3 phase**	**200 3 phase**
No Load Loss	113		225
Load Loss	973		2015

Clause 6.6 - In addition to the requirements of Clause 6.6 consequential loss charges as specified in the Liquidated Damages for Non-compliance (Clause 6.3), shall be payable to WPD if the arithmetic mean (hereafter "average") no load loss, or the average load loss of each rating of transformer supplied over six monthly periods exceeds the guaranteed losses. Tolerances are permitted on individual transformers.

6.6.1 Dual ratio transformers

The load loss shall be guaranteed at 11000V condition but measured in both 11000V and 6600V conditions.

7.0 CONNECTION AND PHASE DISPLACEMENT SYMBOLS FOR THREE PHASE TRANSFORMERS

Clause 7 of ENA Technical Specification 35-1 applies.

8.0 RATING PLATES

Clause 8 of ENA Technical Specification 35-1 applies.

Clause 8.3 - Connection plates clearly showing the connections necessary to utilise 2 wire or 3 wire configurations and tapping arrangements shall be provided where appropriate. The neutral terminal shall be clearly identified.

Clause 8.3 - For dual ratio transformers the selected primary voltage shall be clearly identifiable and the tapping voltages given for both 6.6 and 11kV primary voltage. The transformer shall be supplied selected to 6.6kV.

The Rating and Connection plate layout for each type of transformer shall be submitted at the time of tender for approval.

9.0 SAFETY, ENVIRONMENTAL AND OTHER REQUIREMENTS

9.2 - The neutral conductor and terminals shall be of the same rating as the phase conductors and terminals, unless a double rated neutral is specified at the time of tender.

9.3 - Ground mounted transformers shall be free breathing.

9.3 - Pole mounted transformers can be either of the options specified. If sealed the over pressure relief valve shall be designed so accidental or easy manual operation of the valve is not possible. Thought should be given to the design to prevent the tank form flexing in and out when a sealed design is provided.

9.5 **Centre of gravity**

Clause 9.5 of ENA Technical Specification 35-1 part 1 applies.

10.0 TOLERANCES

Clause 10 of ENA Technical Specification 35-1 part 1 applies.

11.0 TESTS

Clause 11.1 of ENA Technical Specification 35-1 applies.

11.1.1 General

11.1.1 Of ENA Technical Specification 35-1 part 1 applies

Dielectric test levels shall adhere to the values required for each transformer type Specified in Parts 2-4 of this specification

11.1.2 Routine tests

Clause 11.1.2 Of ENA Technical Specification 35-1 part 1 applies see table 2.

Table 2 – Transformer routine tests

IEC 60076-1 routine tests	Test(s)	Comment
11.2.1 a), b), c), d)	Measurement of: winding resistance; voltage ratio and phase displacement; short-circuit impedance and load loss; no –load loss and current	Required
11.2.1 e)	Dielectric test	Required – see Table 3
11.2.1 f)	Test on energised tap-changers	NOT required
11.2.1 g)	Leak testing with pressure for liquid-immersed	Required
11.2.1 h)	Tightness and pressure for gas-filled	NOT required
11.2.1 i), j)	Check of: ratio and polarity of CTs; core and frame insulation	Required, where fitted

Table 3 – Transformer dielectric tests

IEC 60076-3 dielectric tests	Test	Comment
7.3.1.1 a)	Applied voltage test (AV)	Required
7.3.1.1 b)	Induced voltage withstand test (IVW)	Required

11.1.3 Type tests

Clause 11.1.3 of ENA Technical Specification 35-1 part 1 shall apply

12.0 ELECTROMAGNETIC COMPATIBILITY (EMC)

Clause 12 of ENA Technical Specification 35-1 part 1 applies.

14 Transformer details

14.2 Surface finish

Clause 14.2 ENA Technical Specification 35-1 part 1 applies.

All pole mounted transformers shall comply with clause 14.2 and shall be hot dip galvanised to prevent costal corrosion and as per EN ISO 12944-2 C5.

15 Documentation

Clause 15 ENA Technical Specification 35-1 part 1 applies.

PART 2 GROUND MOUNTED TRANSFORMERS - NOT CLOSE COUPLED (CABLE CONNECTED)

This part must be read in conjunction with Part 1

4 Additional requirements for ground mounted transformers – not close coupled

4.1 General

Ground mounted transformers – not close coupled shall be configured as per layout option a) of ENA Technical Specification 35-1 part 2 and all transformers shall comply with the limiting dimensions indicated in Figure 2 of ENA Technical Specification 35-1 part 2.

4.3 HV terminations

4.3.1 General

HV phase markings shall be 1U, 1V, 1W and shall be provided on the transformer side face.

4.3.2 HV side face terminations

HV side face termination are required and shall be either an HV cable box or HV flange, these shall conform to Clauses 4.3.2.1 and 4.3.2.2 of ENA Technical Specification 35-1 part 2.

4.3.2.1 HV cable box

A cable box shall be provided where specified. The termination interface type shall be 630A Type C1 profile separable connector.

The cable box position will be as per Figure 2 of ENA Technical Specification 35-1 part 2 and its design as per Clause 4.3.2.1 of ENA Technical Specification 35-1 part 2.

4.3.2.2 HV flange

Where specified a HV flange shall conform to Clause 4.3.2.2 of ENA Technical Specification 35-1 part 2 applies.

4.3.3 HV top cover terminations

HV top cover terminations are not permitted.

4.4 LV terminations

Clause 4.4 of ENA Technical Specification 35-1 part 2 shall apply.

4.4.1 General

LV phase markings shall be 2W, 2V, 2U, 2N. LV terminations shall be provided as side face terminations.

4.4.3 LV top cover terminations

LV top cover terminations are not permitted.

4.5 Connection and phase displacement

Three phase transformers shall be connected delta-star, in accordance with vector group Dyn11

4.6 Specification of tappings

All three-phase transformers shall be provided with a de-energised tap-changer. Tappings shall be provided on the higher voltage winding for a variation of no load primary voltage of -5% -2.5%, 0%, +2.5% and +5%

4.6.2 Tapping/ratio position locking

The tappings shall be provided by means of an externally operated self-positioning tapping switch in accordance with IEC 60214-1 Section 7 – Requirements for Off-Circuit Tap-Changers. Switch position no. 1 shall correspond to the maximum plus tapping. Provision shall be made for locking the tapping switch handle at any tapping position, by means of a padlock with 41mm square body and with a 4mm to 7mm diameter shackle having a clear inside width of 21mm and an inside length of 16mm to 45mm.

The holes provided for the shackle shall not be less than 8mm diameter.

The switch shall be retained in a safe position if a padlock with a 4 mm diameter shackle is used. Padlocks shall not be provided.

A label in accordance with **figure 15 shall be fitted adjacent to the tapping switch see Appendix C.**

4.7 Fittings

Clause 4.7 of ENA Technical Specification 35-1 part 2 shall apply.

4.7.1 General

The requirements of ENA TS 35-1 clause 14.5 shall apply.

All fittings shall not be obstructed.

5 Tests for ground mounted – not close coupled

5.1 Dielectric test levels

Clause 5.1 – Dielectric test levels shall be in accordance with table 1 of ENA TS 35-1 part 2

Highest voltage for equipment U_m (r.m.s) kV	**Nominal system voltage kV**	**Rated lightening impulse voltage (Li) kV (peak)**	**50 Hz withstand voltage kV (r.m.s)**
1.1	0.400/0.230	-	3
7.2	6.6	75	20
12	11	95	28
24	20	145	50

Table 1 – Insulation levels for ground mounted transformers

See ENA TS 35-1 part 2 page 16 onwards for limiting drawings and arrangement drawings.

PART 3 GROUND MOUNTED TRANSFORMERS – CLOSE COUPLED (UNIT TYPE)

This part must be read in conjunction with Part 1

4 Additional requirements for ground mounted transformers – close coupled

4.1 General

Ground mounted transformers – close coupled shall be configured as per layout option d) of ENA Technical Specification 35-1 part 3 and all transformers shall comply with the limiting dimensions indicated in Figure 3 of ENA Technical Specification 35-1 part 3

4.3 HV terminations

4.3.1 General

HV phase markings shall be 1U, 1V, 1W and shall be provided on the transformer side face.

4.3.2 HV cable box

HV cable box is not permitted.

4.3.3 HV separable connectors

HV separable connections are not permitted.

4.3.4 HV ring main unit

Clause 4.3.4 of ENA Technical Specification 35-1 part 3 applies

4.4 LV terminations

Clause 4.4 of ENA Technical Specification 35-1 part 3 shall apply

4.4.1 General

LV phase markings shall be 2W, 2V, 2U, 2N. LV terminations shall be in accordance with ENA TS 35-1 part 3 Clause 4.4.1.

4.4.2 LV cable box

LV cable box are not permitted.

4.5 Connection and phase displacement

Three phase transformers shall be connected delta-star, in accordance with vector group Dyn11.

4.6 Specification of tappings

All three-phase transformers shall be provided with a de-energised tap-changer. Tappings shall be provided on the higher voltage winding for a variation of no load primary voltage of -5% -2.5%, 0%, +2.5% and +5%.

4.6.1 Dual ratio transformers

Clause 4.6.1 of ENA TS 35-1 part 3 applies

4.6.2 Tapping/ratio position locking

The tappings shall be provided by means of an externally operated self-positioning tapping switch in accordance with IEC 60214-1 Section 7 – Requirements for Off-Circuit Tap-Changers. Switch position no. 1 shall correspond to the maximum plus tapping. Provision shall be made for locking the tapping switch handle at any tapping position, by means of a padlock with 41mm square body and with a 4mm to 7mm diameter shackle having a clear inside width of 21mm and an inside length of 16mm to 45mm.

The holes provided for the shackle shall not be less than 8mm diameter.

The switch shall be retained in a safe position if a padlock with a 4 mm diameter shackle is used. Padlocks shall not be provided.

A label in accordance with **figure 15 shall be fitted adjacent to the tapping switch see Appendix C.**

4.7 Fittings

Clause 4.7 of ENA Technical Specification 35-1 part 3 shall apply.

4.7.1 General

The requirements of ENA TS 35-1 clause 14.5 shall apply.

All fittings shall not be obstructed.

5 Tests for ground mounted – close coupled

5.1 Dielectric test levels

Clause 5.1 – Dielectric test levels shall be in accordance with table 1 of ENA TS 35-1 part 2.

Highest voltage for equipment U_m (r.m.s) kV	Nominal system voltage kV	Rated lightening impulse voltage (Li) kV (peak)	50 Hz withstand voltage kV (r.m.s)
1.1	0.400/0.230	-	3
7.2	6.6	75	20
12	11	95	28
24	20	145	50

Table 1 – Insulation levels for ground mounted transformers

5.2 Temperature rise test

The temperature rise test shall be carried out with the transformer fitted with assemblies that represent an HV ring main unit and an LV PENDA – TMO

See ENA TS 35-1 part 3 page 16 onwards for limiting drawings and arrangement drawings.

PART 4 POLE MOUNTED TRANSFORMERS

This part must be read in conjunction with Part 1.

4 Additional requirements for pole mounted

4.1 General

The fixing arrangement for pole mounted transformers shall be as per clause 4.1 ENA TS 35-1 part 4.

The mounting arrangements are shown in Table 1 of ENA TS 35-1 part 4. Deviations from the mounting arrangements in Table 1 shall not be permitted, all sizes of pole mounted transformers shall be mounted as per Table 1 i.e. 25kVA single phase shall be mounted on a single bolt fixing.

Lifting lugs shall be positioned to facilitate lifting in an upright position.

4.2 Termination bushings

Clause 4.2 of ENA TS 35-1 part 4 applies.

4.3 HV terminations

The overall height of HV bushings shall be in accordance with ENA TS 35-1 part 4 figures 1-3. HV bushings shall be mounted on the side of the tank as per Figure 1-3.

Surge arrestors and brackets shall be fitted, the surge arrestors shall be of class 2 as per Western Power Distributions Engineering Specification EE 84.

The transformer manufacturer will provide wildlife protection for the HV bushing, the HV surge arrestor and any open metal work connecting the HV bushing to the HV surge arrestors.

Phase markings shall be in accordance with ENA TS 35-1 part 4 clause 4.3.

4.4 LV terminations

LV terminations shall be mounted on the side wall, mounting of the LV terminations on the top cover is not permitted.

An LV surge arrestor shall be supplied and fitted in the neutral circuit external to the transformer.

Clause 4.4 of ENA Technical Specification 35-1 part 4 shall apply for all single phase transformers, the conversion between 2 and 3 wire systems shall be completed with no additional parts or links.

4.5 Connection and phase displacement

Three phase transformers shall be connected delta-star, in accordance with vector group Dyn11.

Clause 4.5 of ENA TS 35-1 part 4 applies.

Single phase 25 and 50kVA transformers shall have their lower voltage windings arranged to give a 2-wire or 3-wire supply. Internal connectors shall not be used.

Single phase transformers of 100kVA shall have their lower voltage windings arranged to give a 3-wire supply.

4.6 Specification of tappings

4.6.1 General

Clause 4.6.1 of ENA TS 35-1 part 4 applies.

All transformers shall be provided with a de-energised tap-changer.
Tappings shall be provided on the higher voltage winding for a variation of no load primary voltage of -5% -2.5%, 0%, +2.5% and +5%

4.6.2 Single phase 25kVA and 50kVA transformer tappings

Clause 4.6.2 of ENA TS 35-1 part 4 applies

4.7 Fittings

Clause 4.7 of ENA Technical Specification 35-1 part 3 shall apply.

4.7.1 General

The requirements of ENA TS 35-1 clause 14.5 shall apply.

All fittings shall not be obstructed.

5 Tests for pole mount

5.1 Dielectric test levels

Clause 5.1 – Dielectric test levels shall be in accordance with table 1 of ENA TS 35-1 part 4.

Table 3 – Insulation levels for pole mounted transformers

Highest voltage for equipment U_m (r.m.s) kV	Nominal system voltage kV	Rated lightening impulse voltage (Li) kV (peak)	50 Hz withstand voltage kV (r.m.s)
1.1 (note 2)	0.400/0.230	30	10
1.1	0.400/0.230	-	3
7.2	6.6	75	20
12	11	95	28
24	20	145	50

See ENA TS 35-1 part 4 page 16 onwards for limiting drawings and arrangement drawings

PART 5 PAD MOUNT TRANSFORMERS

1 General

1.1 Pad mount transformers are a compact low profile ground mounted transformer for use where space is a premium or in areas of outstanding natural beauty where an overhead distribution system may not be appropriate. They will be used as a tee-off substation between two conventional ring main units. They shall be compliant with ANSI C57-12-25/26 and the eco directive 2009/125EC No 548/2014.

1.2 The general clauses of this specification will apply to padmounts as applicable. The standard sizes given in Table 4 will be required:-

kVA	No. of phases	Voltage Ratio	ELSP Fuse Rating	Bay-o-net Fuse Rating	Outgoing fuseways
50 kVA	1	11,000 : 250 V	15.5kV 40A	12A	400A 1 way 1 phase
100 kVA	3	11,000 : 433-250 V	15.5kV 40A	12A	400A 2 way 3 phase
200 kVA	3	11,000 : 433-250 V	15.5kV 100A	25A	400A 2 way 3 phase

Table 4 - Padmount Details

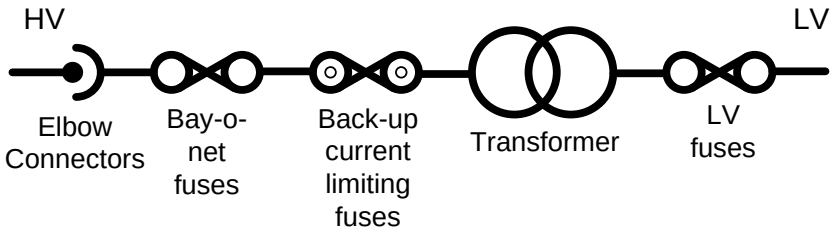
1.3 Padmount transformers will have the following parameters.

Network Parameter	12kV Network	1.1kV LV Network
Nominal voltage	11,000 V	250 V
Lightning impulse (peak)	95 kV	-
Power frequency withstand for 1 minute	28 kV	10 kV

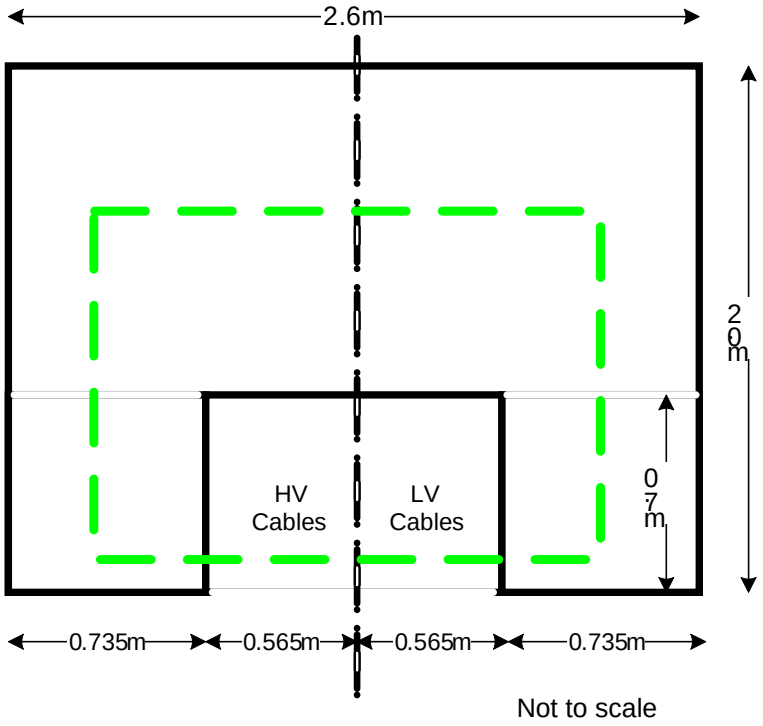
1.4 Padmounts with a rating of 200kVA or below shall not be equipped with corrugated tanks or radiators. Lower losses than those calculated to optimise capitalisation or maximum loss requirements may be necessary.

1.5 Preferred pad mount impedances shall be under 3%.

1.6 ELSP Current-Limiting Backup Fuses shall be fitted within the transformer tank and will not necessarily be readily accessible. The sizes required are given in Table 4. Schematically the padmount shall be as shown below:



1.7 The padmount will be suitable for mounting on the plinth drawing given below:



1.8 The maximum dimensions of all sizes of padmount will be 1800mm wide, 1300mm deep and 1200mm tall. Consideration will also be given to a taller unit if this suits the manufacturers design. Any upwardly opening covers shall be designed that the maximum height of the unit with the covers open, or partially open, shall be 2100mm.

1.9 The padmount shall have two separate compartments one HV and one LV. The HV and LV compartment shall be on the same side of the transformer with the LV compartment on the right.

1.10 The LV compartment shall be lockable with a padlock of the following dimensions: body up to 63 mm square, 6 to 10mm diameter shackle having a clear inside width of 35 mm and an inside length of between 25 mm and 45 mm. The hole provided for the shackle shall be not less than 12 mm diameter. The compartment shall also be locked off using a penta head bolt with the housing capable of taking a padlock as detailed above.

1.11 The HV compartment shall be lockable as follows:-

a) Externally using a padlock and
b) Bolted closed with two bolts and
c) Interlocked from within the LV compartment.

It shall be possible to lock a) and c) with a padlock of the following dimensions: body up to 41mm square, 4mm to 7mm diameter shackle having a clear inside width of 21mm and an inside length of 16mm to 45mm. The holes provided for the shackle shall not be less than 8mm diameter.

1.12 The HV compartment shall house:-

a) Cooper 200A 15kV Class Load-break Bushing Insert fitted with protective caps. Sufficient clearance shall be provided to allow cables to be connected using Cooper 200A Load-break Elbow Connectors when all doors/covers are closed. Sufficient access shall be required to allow unplugging / plugging of the load break elbows using a gripall stick.

b) A parking bracket adjacent to each load break bushing, suitable to hold a Cooper 200A Load-break Rotatable Feed thru Insert. Sufficient clearance shall be provided to allow Cooper 200A Load-break Elbow Connectors to be connected to the Feed thru Insert when all doors/covers are closed.

c) Cooper "Bay-O-Net" fuse assemblies fitted with dual element fuses as detailed in Table 4 and fitted with drip trays.

d) HV tapping switch as detailed in Clause 5.4.2. An anti-vandal cover shall not be required.

e) An earth bar.

1.13 The LV compartment shall house:-

a) Oil level gauge

b) Free breather

c) Rating Plate

d) LV outgoing ways generally to ENA Technical Specification 37-2 Issue 4 as appropriate. Current rating and number of ways is detailed Table 4. The outgoing contacts shall be fitted with M10 x 45 HEX HD screw, spacing washer, 2 x plain washers and shake proof washer to accept cable lugs suitable to terminate 95 or 185mm² Wavecon cable to BS7870 Pt3.40.

e) A female 600A 'Litton' connector (or equivalent) shall be provided on the neutral/earth bar to allow the safe connection of generator cables onto a live padmount.

f) Ideally 'Litton' connectors (or equivalent) shall be provided on each phase for the safe connection of generator cables onto a live padmount, but it is appreciated that space/access may prevent this. If it is possible to fit these connectors the extra cost of doing so should be identified separately at the time of tender.

APPENDIX A

ENA Technical Specification 35-1 - Self Certification Conformance Declaration for Distribution Transformers shall be completed by the tenderer.

APPENDIX B

SPECIFICATION FOR WPD 12kV DISTRIBUTION TRANSFORMERS

TECHNICAL SCHEDULE (To be completed by the Tenderer)

MANUFACTURER:-

Continuous rating in accordance with BS171-1978						
1	Continuous rated kVA at	5°C ambient temp % 10°C ambient temp %				
2	Type of core material					
3	Method of core clamping					
4	Max. flux density Wb/m^2	cores yoke				
5	Fixed losses at nominal ratio (Iron) watts					
6	Load losses at 75°C nominal ratio and rated kVA (Copper) watts					
7	Current density in windings	HV amps / sq cm LV				
8	Regulation at 75°C rated kVA and nominal ratio	(a) Unity p f (b) 0.8 p f lag				
9	Impedance volts at 75°C and rated kVA	(a) Max. tap (b) Nominal ratio (c) Min. tap				
10	Types of winding	(a) HV (b) LV (c) Location of tapping section (d) If foil - method of making foil termination				
11	Insulation of	(a) HV winding*/material (b) LV winding*/material (c) tapping (d) tapping connection (e) core bolts (f) core bolt washers (g) side plates (h) core laminations				
	* If foil - state number of papers between layers					

Continuous rating in accordance with BS171-1978						
12	Calculated thermal time constant					
13	Tank thickness	(a) sides (b) bottom (c) top-plate (d) radiators	mm mm mm mm			
14	Total oil required		litres			
15	Proposed supplier and type of oil					
16	Volume of oil to be removed to enable change of cable box		litres			
17	Weight of core and winding assembly		Kg			
18	Total weight including oil		Kg			
19	Outline drawing number (typical)					
20	Envelope dimensions (over-cable boxes, where applicable)		Height mm			
			Width mm			
21			Length mm			
22	Noise level dBA from type test					
23	Type of bushings, if non ESI 35-1 stem diameters and materials					
24	Thickness of galvanising/zinc spray (specify which)					
	Proposed paint system: numbers and types of coats and dry film thicknesses					

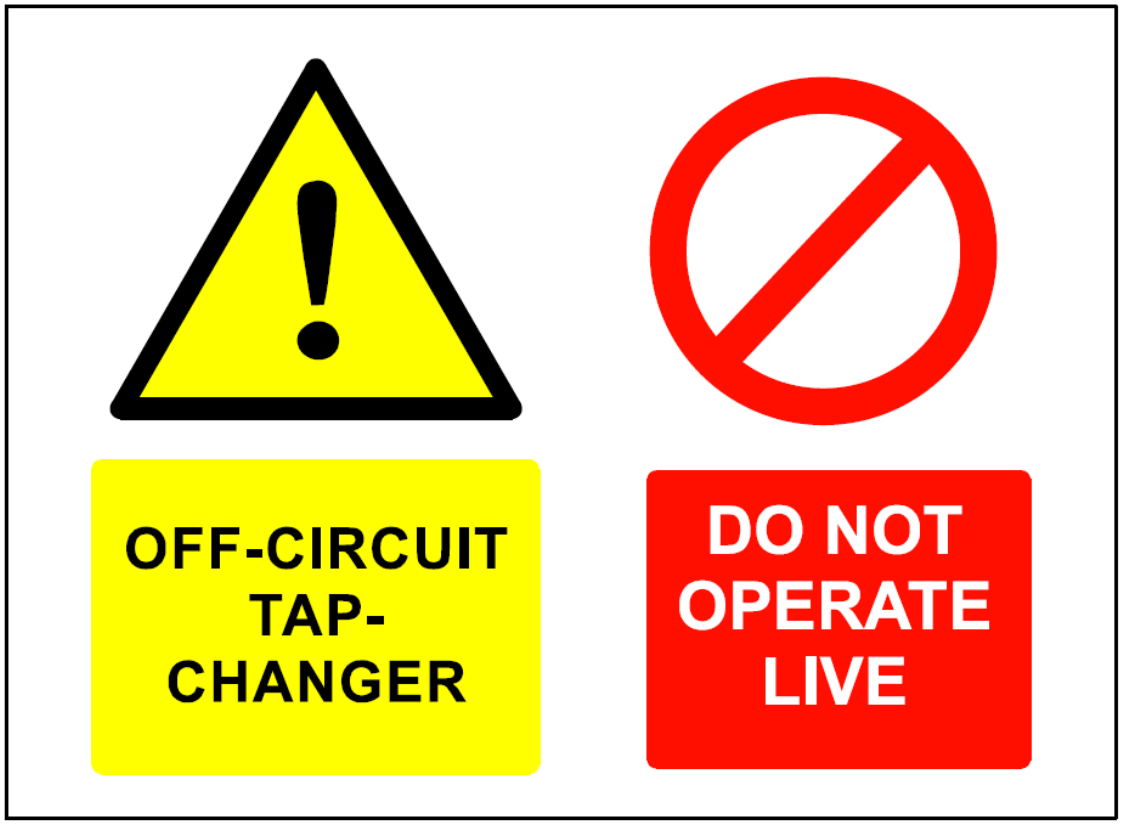


Fig. 15. Warning Label For Off-Circuit Tapping Switch And Voltage Ratio Change Switch

APPENDIX D

SUPERSEDED DOCUMENTATION

This document supersedes EE SPEC: 5/5 dated August 2014 which has now been withdrawn.

APPENDIX E

RECORD OF COMMENT DURING CONSULTATION

No comments received.

APPENDIX F

ASSOCIATED DOCUMENTATION

ENATS 35-1 2014
ANSI C57-12-25/26
IEC60076
ECO Directive 2009/125/EC No 584/2014

APPENDIX G

IMPACT ON COMPANY POLICY

Update of specification in line with the latest national and international specifications and standards.

The inclusion of the new European eco directive transformer losses.

APPENDIX H

IMPLEMENTATION OF POLICY

This document shall be implemented on issue.

APPENDIX I

KEY WORDS

Distribution Transformer, Padmount, Pole Mounted, Ground Mounted.